

Is Homelessness Hazardous to Your Health?

Obstacles to the Demonstration of a Causal Relationship

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ABSTRACT

Background: Homeless people suffer from high levels of morbidity and mortality, but there is surprisingly little empiric evidence that homelessness has a direct adverse effect on health.

Methods: This study examined the relationship between shelter use and risk of death using longitudinal data in a cohort of 8,769 homeless men in Toronto, Ontario. Shelter use was modelled as a time-dependent covariate in a Cox regression analysis.

Results: In a model adjusted for age and previous pattern of homelessness, the risk of death during months in which homeless shelters were used was significantly increased (hazard ratio, 1.84; 95% confidence interval, 1.27-2.67).

Conclusions: Among men, periods of homeless shelter use are associated with higher mortality. There are three reasons why this finding does not necessarily mean that homelessness itself increases the risk of death. First, the hazard of death associated with shelter use compared to non-shelter use may be significantly different from that associated with homelessness compared to non-homelessness. Second, the association between shelter use and risk of death may be confounded by other variables such as alcohol and drug use. Finally, because the mechanism and time-course of the putative effect of homelessness on health is uncertain, appropriate modelling of the time-dependent covariate is difficult to ensure. Further research into the possible adverse effects of homelessness on health is needed and would have important implications for public policy.

La traduction du résumé se trouve à la fin de l'article.

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Homeless persons suffer from high levels of illness.¹⁻⁷ The link between homelessness and poor health has been generally assumed to be bi-directional: sick people become homeless, and homelessness makes people sick.⁸⁻¹⁰ If the homeless state causes and exacerbates physical and mental illness,^{9,11,12} one could argue that affordable housing that prevented homelessness would also improve public health. Despite the intuitive plausibility of the assertion that homelessness causes poor health, there is surprisingly little empiric evidence to support this claim.

Homeless persons have high mortality rates.¹³⁻²¹ The risk of death is greatest among homeless persons with HIV infection, renal or liver disease, arrhythmias, or a history of previous incarceration or chronic homelessness.^{15,22} If the increased risk of death among homeless persons is due to relatively fixed characteristics, the magnitude of risk should remain constant regardless of housing status. If homelessness has a direct adverse effect on health, however, the risk of death should be higher when the person is homeless and lower when the person is housed.

No previous study has shown such a time-dependent association. We present data from a cohort of homeless men in Toronto demonstrating that an individual's risk of death is increased during periods of shelter use. Although this finding is provocative, this association does not necessarily demonstrate a cause-and-effect relationship. This paper examines why it is surprisingly difficult to confirm the seemingly obvious hypothesis that homelessness is hazardous to one's health.

METHODS

Toronto maintains a database of individuals using homeless shelters. We studied single men aged 18 to 64 years old who used shelters in 1995. Although a significant number of adolescents and young women with children are homeless,²³ these groups were not included in our cohort. Dates of each man's shelter utilization were determined from entry into the cohort (the first day of shelter use in 1995) until December 31, 1997. Deaths during this period were ascertained using Ontario death certificate records.¹⁶

Each person's history of shelter use over the year preceding their entry into the

cohort was classified as none, transitional, episodic, or chronic. This categorization is based on a previously described cluster analysis technique.²⁴ Briefly, transitionally homeless individuals enter the shelter system for only one or two brief stays. Episodically homeless persons move in and out of homelessness more frequently, with multiple stays of varying lengths. Chronically homeless persons reside more or less permanently in the shelter system.

The cohort (Table I) consisted of 8,769 men with a mean age of 36 years and a mean shelter utilization of 24 days (median, 8 days) in 1995. During a mean follow-up of 31 months, 183 men (2% of the cohort) died. Mortality rates in this cohort have been reported previously.¹⁶ Cohort members used shelters during 15% of follow-up months, but 24% of deaths occurred during months in which the decedent was using a shelter.

Because homelessness is a transient state,²⁴⁻²⁶ longitudinal assessment of exposure to homelessness is necessary. In Toronto, a database identifies all individuals using homeless shelters on any given day. We therefore used admission to a homeless shelter as a proxy indicator of homelessness.

Our goal was to determine if risk of death increases during periods of homelessness. We constructed Cox regression models to estimate the effect of individual characteristics on hazard of death. Age and history of shelter use prior to entry into the cohort were included as fixed covariates. A covariate whose value can change over time is known as time-dependent.²⁷ We modelled homelessness as a time-dependent covariate that reflected shelter use during each calendar month of follow-up. In Model 1, each calendar month was designated a homeless month (at least one night spent in a shelter) or a non-homeless month (no nights spent in a shelter). The time-dependent covariate was coded dichotomously to test the hypothesis that the hazard of death increases a fixed amount during homeless months and decreases back to baseline during non-homeless months. In Model 2, the time-dependent covariate was a continuous variable equal to the number of nights spent in shelters during each calendar month. This model tested the hypothesis that the risk of death during a given month is proportional to the number of days spent homeless that month.

TABLE I

Characteristics of Men 18 to 64 Years Old Who Used Homeless Shelters in Toronto in 1995, with Deaths Ascertained Through the End of 1997

Characteristic	Number (%)	Number deceased (%)
All individuals	8,769 (100)	183 (2.1)
Age* (years)		
18-24	1,046 (11.9)	11 (1.1)
25-44	6,143 (70.1)	105 (1.7)
45-64	1,580 (18.0)	67 (4.2)
Pattern of homelessness during preceding year*		
No shelter use	7,148 (81.5)	134 (1.9)
Transitional	1,417 (16.2)	39 (2.8)
Episodic	160 (1.8)	8 (5.0)
Chronic	44 (0.5)	2 (4.5)

* Determined on the individual's first day of shelter use in 1995.

TABLE II

Univariate Cox Survival Models in a Cohort of Shelter-using Men in Toronto

Variable	Unadjusted Relative Risk (95% CI)
Age (per additional decade)	1.72 (1.51-1.96)
Homelessness during the month (Time-dependent covariate – Model 1)*	2.20 (1.54-3.14)
Homelessness during the month (Time-dependent covariate – Model 2)†	1.64 (0.85-3.16)
Pattern of homelessness during year preceding entry into cohort	
No shelter use (reference category)	1.00
Transitional	1.30 (0.91-1.86)
Episodic	2.25 (1.10-4.61)
Chronic	2.10 (0.52-8.51)

* "Homelessness during the month" is modelled as a dichotomous variable; relative risk is shown for any shelter use during the month compared to no shelter use during the month (see text for details).

† "Homelessness during the month" is modelled as a continuous variable (number of days of shelter use during the month); relative risk is shown for 30 days of shelter use during the month compared to no shelter use during the month (see text for details).

TABLE III

Multivariate Cox Survival Models in a Cohort of Shelter-using Men in Toronto

Variable	Adjusted Relative Risk (95% CI)	
	Time-Dependent Covariate – Model 1*	Time-Dependent Covariate – Model 2†
Age (per additional decade)	1.69 (1.48-1.93)	1.70 (1.49-1.95)
Homelessness during the month (Time-dependent)	1.84 (1.27-2.67)	1.10 (0.55-2.20)
Pattern of homelessness during year preceding entry into cohort		
No shelter use (reference category)	1.00	1.00
Transitional	1.14 (0.79-1.65)	1.24 (0.87-1.78)
Episodic	1.49 (0.71-3.11)	1.90 (0.92-3.92)
Chronic	1.13 (0.28-4.64)	1.41 (0.34-5.87)

* "Homelessness during the month" is modelled as a dichotomous variable; relative risk is shown for any shelter use during the month compared to no shelter use during the month (see text for details).

† "Homelessness during the month" is modelled as a continuous variable (number of days of shelter use during the month); relative risk is shown for 30 days of shelter use during the month compared to no shelter use during the month (see text for details).

RESULTS

In univariate models (Table II), risk of death was significantly associated with age and previous episodic homelessness. In Model 1 of the time-dependent covariate, homeless months were associated with a two-fold increase in the hazard of death. In Model 2 of the time-dependent covariate, the hazard ratio was similar but failed to

reach statistical significance. In multivariate models (Table III), only age and homelessness during the month (Model 1 of the time-dependent covariate) were significantly associated with hazard of death. Previous pattern of homelessness exerted a minor confounding effect but did not attain statistical significance.

The association between shelter use and mortality risk was seen in all age groups.

The association was not limited to persistently homeless individuals; in an analysis that excluded men with a history of episodic or chronic homelessness, the age-adjusted relative risk associated with shelter use was 1.93 (95% CI, 1.33-2.82). In a multivariate model adjusted for age and previous pattern of shelter use, the hazard of death due to homicide or suicide was markedly elevated during months in which homeless shelters were used (relative risk, 5.45; 95% CI, 1.80-16.5).

DISCUSSION

The hazard of death in this cohort of men rose about two-fold during months of homeless shelter use. A causal association is clearly plausible, particularly for death due to homicide or suicide. Homelessness could increase the risk of being murdered by placing individuals in environments with a high prevalence of violence and could increase the risk of suicide by inducing depression and feelings of hopelessness. Our findings, however, do not necessarily prove that homelessness directly increases the risk of death. Three major methodological obstacles stand in the way of the demonstration of a causal relationship: the assessment of exposure to homelessness, the possibility of confounding by unmeasured variables, and the proper modelling of the time-dependent covariate.

Assessment of exposure to homelessness

A study of the effect of homelessness on health must accurately assess when an individual is homeless. Because our study equated shelter use with homelessness, we misclassified periods of living on the street as periods of non-homelessness. This could have two opposing effects on the apparent association between shelter use and mortality. Homeless people living outside may move into shelters when they become too ill to live on the street. This phenomenon would increase the apparent risk associated with periods of shelter use. On the other hand, cross-sectional studies have shown that homeless people living on the street have higher mortality rates than homeless people in shelters, who in turn have higher mortality rates than people who are housed.¹⁹ The misclassification of periods of street homelessness as periods of non-

homelessness therefore creates a bias towards underestimating the risk of death associated with shelter use. Because the net effect of these two opposing biases is unknown, the hazard of death associated with shelter use compared to non-shelter use may be significantly different from that associated with homelessness compared to non-homelessness.

Confounding by unmeasured variables

A greater concern is that unmeasured confounders could explain the association between homelessness and mortality. Confounders are variables that are associated with both the putative predictor variable and the outcome of interest. For example, increased alcohol and drug use could lead to homelessness by diverting funds away from rent payment⁹ and simultaneously increase the risk of death due to overdose or injury.^{22,28} Under this scenario, a statistical model examining the relationship between homelessness and risk of death that did not include substance use as a covariate would incorrectly attribute the adverse effect of substance use to homelessness. However, our administrative database lacked information on clinical characteristics, limiting our ability to adjust for potential confounders such as substance use.²⁹

Modelling of the time-dependent covariate

A final issue is the proper modelling of the predictor variable of homelessness in the statistical analysis. When using a time-dependent covariate, one should consider the hypothesized mechanisms underlying the effect of the covariate on the outcome of interest.²⁷ For example, when examining the effect of smoking on risk of death, smoking would be better modelled as the cumulative number of cigarettes smoked over a lifetime, rather than simply whether or not an individual is a smoker at the present moment.

In contrast to smoking, data are not available to guide the modelling of the putative effect of homelessness on health. Many measures of homelessness could be plausibly linked to an adverse health effect, including cumulative exposure to homelessness over one's lifespan, duration of the current episode of homelessness, any expo-

sure to homelessness within a recent time interval, or the proportion of time spent homeless within a recent time interval. We were able to use the latter two measures. The association between shelter use and hazard of death was statistically significant when shelter use was modelled as any use compared to no use during each month, but not when modelled as the actual number of days of shelter use during each month. This result suggests that entrance into the shelter system coincides with a period of adverse circumstances whose deleterious health effects persist throughout the period of housing instability. While an association between the number of days of shelter use during each month and risk of death would have been more strongly supportive of a direct adverse health effect of homelessness, we did not detect such a relationship.

The possibility of a time-lag in the effect of homelessness on health is an important consideration. Homelessness might cause health status to deteriorate by various mechanisms, such as impairing access to routine health care.³⁰ Deterioration in health status could ultimately lead to increased mortality risk. However, this effect might not be seen during the months that the individual is homeless; instead, the risk of death might become apparent months or years later. Our time-dependent models would not have been sensitive to such a relationship.

Other limitations

Ascertainment of deaths in our cohort may have been incomplete, particularly for homeless men using aliases. However, there is no reason to believe that ascertainment of deaths was more complete during periods of shelter use than periods of non-shelter use. Hospital stays may have introduced a bias because they appeared as periods of non-shelter use in our database. Because hospitalization is clearly a time during which the risk of death is heightened, this bias would tend to reduce the apparent risk of death associated with shelter use.

CONCLUSIONS

Our finding that periods of shelter use are associated with a significantly increased risk of death falls short of demonstrating a

causal link between homelessness and mortality. A definitive answer to this question would require a large prospective longitudinal cohort study with frequent and accurate measurement of exposure to homelessness, potential confounding factors such as substance use, and health status. To our knowledge, such a study has not been done.

Regardless of the underlying mechanisms, the association between shelter use and risk of death is real and has important clinical implications. Health care providers working with homeless people should realize that homelessness is a period of heightened risk in these individuals' lives. Ensuring that homeless people have adequate access to health care is therefore a particularly important concern. Clinicians should be alert for any signs of acute deterioration in health during episodes of homelessness.

Decent housing for all members of society is an important goal, regardless of its effect on health. Nonetheless, a growing body of evidence suggests that adequate housing has the added benefit of improving health.³¹ This position has long been espoused by advocates for the homeless who emphasize that homeless people need not only access to health care, but also access to affordable housing.³² Further research into the possible adverse effects of homelessness on health is greatly needed and would have important implications for public policy.

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RÉSUMÉ

Contexte : Les sans-abri présentent des taux de morbidité et de mortalité élevés, mais les preuves empiriques des effets indésirables de la clochardise sur la santé sont étonnamment rares.

Méthode : À l'aide de données longitudinales, nous avons étudié le lien entre l'hébergement en maison pour sans-abri et le risque de décès dans une cohorte de 8 769 hommes sans abri à Toronto (Ontario). L'hébergement en maison pour sans-abri a été modélisé comme covariable chronologique d'une analyse de régression de type Cox.

Résultats : Selon notre modèle, ajusté selon l'âge et les épisodes antérieurs de clochardise, le risque de décès durant les mois d'hébergement en maison pour sans-abri présentait une hausse significative (coefficient de risque : 1,84; intervalle de confiance de 95 % = 1,27-2,67).

Conclusions : Chez les hommes, les périodes d'hébergement en maison pour sans-abri sont associées à un taux de mortalité supérieure. Mais pour trois raisons, cette constatation ne signifie pas nécessairement que la clochardise accroît en soi le risque de décès. Premièrement, le risque associé à l'hébergement en maison pour sans-abri, par comparaison avec le non-hébergement dans ces maisons, peut différer de manière significative du risque associé à la clochardise par comparaison avec la non-clochardise. Deuxièmement, d'autres variables, comme la consommation d'alcool et de drogues, peuvent brouiller l'association entre l'hébergement en maison pour sans-abri et le risque de décès. Troisièmement, comme on ignore le mécanisme et l'évolution dans le temps de l'effet présumé de la clochardise sur la santé, il est difficile de modéliser convenablement la covariable chronologique. Il faudrait pousser la recherche sur les éventuels effets indésirables de la clochardise sur la santé, ce qui aurait d'importantes incidences sur les politiques gouvernementales.